REMARKS

Applicants respectfully request reconsideration of the above-captioned application. Claims 1-11 are currently pending. The claims and abstract have been amended to improve their readability. The claims have not been narrowed in scope in light of any rejection.

The Office Action includes an objection to the drawings suggesting that the recitation of TFTs for driving the pixel electrodes installed on the inner surface of *each of the front and rear plates* as described in claim 1 is not shown. Applicants respectfully submit that the claims did not intend to convey that the TFTs are on both the inner surfaces. When read in totality, the claim is speaking of a list of different components which are positioned on the inner surface of the front and rear plates. The phrase "each of", which apparently caused the confusion, has been avoided. In light of this change to the claims, Applicants respectfully request reconsideration and withdrawal of the objection to the drawings.

The Office Action includes an objection to claim 1 noting that the phrase "are formed" was repeated inadvertently at line 8 of claim 1. Actually, the original phrase was fine, but could be improved with punctuation and word choice, as reflected in amended claim 1. Accordingly, withdrawal of this objection to claim 1 is respectfully requested.

The Office Action includes a rejection of claims 1, 3 and 4 under 35 U.S.C. §103 as allegedly being unpatentable over the *Shirasaki et al.* patent (U.S. Patent No. 6,025,894) in

view of the *Littman et al.* patent (U.S. Patent No. 5,688,551); a rejection of claims 5-11 under 35 U.S.C. §103 as allegedly being unpatentable over the *Shirasaki et al.* patent in view of the *Littman et al.* patent, and in further view of the *Hodson* patent (U.S. Patent No. 5,760,858) (cited by Applicants); and, finally, a rejection of claim 2 under 35 U.S.C. §103 as allegedly being unpatentable over the *Shirasaki et al.* patent in view of the *Littman et al.* patent and in further view of the *Nakanishi et al.* patent (U.S. Patent No. 5,969,832). These rejections are respectfully traversed.

The Present Invention

The present invention relates to a liquid crystal display device and, more particularly, to a liquid crystal display device adopting a field emission device as a backlight.

As described at pages 1-4 of the originally filed specification, there are conventional LCD devices wherein the backlight involves a cold cathode lamp in front of which is a liquid crystal panel 1 on which three color filters are installed to constitute a single color pixel. Separate pixel electrodes correspond to the color filters. However, according to this structure, power consumption in the LCD occurs mostly in the backlight because most of the light emitted from the lamp is absorbed in the plate by a reflection plate and scattering structure installed on the light plate. The amount of light actually used for the image display is smaller in proportion than the power consumed, thus degrading the efficiency of the power consumption.

Additionally, because each pixel involves three colors, each pixel requires three thin film transistors and three pixel electrodes which further degrades the aperture efficiency. There are other types of structures such as shown in Figure 2 wherein the backlight includes colored fluorescent layers opposite to cathode electrodes which correspond to the colored fluorescent layers. This light then travels through a liquid crystal panel however, as shown in Figure 3, light crosses from one source of color through the liquid crystal for a different color, thus degrading the overall image.

The present invention avoids these problems insofar as, as disclosed at column 7 beginning at line 18, for example, the liquid crystal display according to the present invention has a structure wherein a single pixel serves as three pixels for expressing three colors. Light of a red color, light of a green color and light of a blue color from the backlight are incident upon each single pixel. In the prior art, pixels are divided by colors and each pixel has a pixel electrode and a thin film transistor. However, according to the present invention, a single pixel can serve to express three different colors.

This aspect of the present invention is found in the claims, which recite, *inter alia*, that the light emitting units for colors according to the anode electrodes and the cathode electrodes are installed to provide light of each of red, green and blue colors to each pixel of the liquid crystal panel. This feature, taken in the context of claim 1, is neither found nor rendered obvious by the applied art.

The *Shirasaki et al.* Patent

The *Shirasaki et al.* patent discloses *inter alia* an electrode luminescent layer which, as disclosed in column 13 lines 63 *et seq.* is illuminated in a dark environment so as to provide backlighting to a LCD panel 13. In a bright environment, the electrode luminescent layer 18 is not turned on, but rather reflective properties of the electrode are utilized as represented by the arrow lines Y and X in Figure 1, for instance. What is important to note, in this instance, is that the organic electrode luminescent device 12 is activated to be in a luminescent state. This light then travels through pixel electrodes 30 through the LCD panel and, consequently, through a plurality of color filters 27 before exiting the LCD panel.

Hence, Figure 1 of the *Shirasaki et al.* is similar to what is shown in prior art Figure 1, albeit with an electro luminescent layer as a light source instead of a cold cathode lamp and a light plate. There is no disclosure, however, suggesting or disclosing the present invention and in particular its features as recited in independent claim 1 of the anode electrodes and cathode electrodes being installed to provide light of each of red, green and blue colors to each pixel in the liquid crystal panel.

The *Littman et al.* Patent

The *Littman et al.* patent discloses a method of forming an organic electro luminescent display panel which has column electrodes 120 and row electrodes 140, the crossover points of which are formed of pixels. Each of these crossover points is associated with the three primary color subpixels. What is not shown or taught by the

Littman et al. patent, however, is the very same teaching that is missing from the primary reference; namely, the use of light emitting units for colors according to the anode electrodes and the cathode electrodes which are installed to provide light of each of red, green and blue colors to each pixel of the liquid crystal panel. This structure is shown, for instance, in Figure 4 of the present application, wherein each pixel is associated with an electrode 105 and associated with three different color sources 203R, 203G and 203B, for instance. These colors are emitted selectively by activation of cathodes 207R, 207G, 207B, such that each pixel would provide light from each of the red, green and blue colors. This simultaneously increases efficiency insofar as light is not lost, while promoting good light resolution without substantial crosstalk.

Hence, whether one views the *Shirasaki et al.* patent alone or in combination with the *Littman et al.* patent, not all of the features of independent claim 1 are found.

The Tertiary References

With respect to the *Hobson* patent and the *Nakanishi* patent, it is noted that neither is purported to teach or suggest the distinguishing features drawn upon above. Applicants note that the *Hobson* patent is distinguished in the background section of the present application, those comments being incorporated herein. Additionally, Applicants do not claim that their invention is a high-speed light switch *per se* (see page 9, lines 22-25). It nevertheless remains that this aspect of claim 2 further separates the present invention from the applied art insofar as there would be no reason to use high-speed light switches in the type of art shown in the *Littman et al.* and *Shirasaki et al.* patents.

In light of the foregoing, Applicants respectfully request reconsideration and allowance of the above-captioned application.

Respectfully submitted,

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Attachment to Amendment Dated June 17, 2003

Marked-up Claims 1, 6 and 7

1. (Amended) A liquid crystal display comprising:

a liquid crystal panel having a front plate and a rear plate between which liquid crystal [sandwiches] is interposed, wherein common electrodes for driving the liquid crystal on a pixel-by-pixel basis, pixel electrodes corresponding to the common electrodes, and thin film transistors (TFTs) for driving the pixel electrodes are installed on the inner surface of [each of] the front and rear plates; and

a backlight having a front plate and a rear plate, wherein a plurality of R, G and B anode electrodes, on which fluorescent layers are formed, [are formed] are located in parallel on the front plate, cathode electrodes corresponding to the anode electrodes are formed on the rear plate, and light emitting units for colors according to the anode electrodes and the cathode electrodes are installed to provide light of each of R, G and B colors to each pixel of the liquid crystal panel.

6. (Amended) The liquid crystal display of claim 5, wherein one of the R, G and B anode electrodes is connected to a first bus line which is formed on one portion of the inner surface of the front plate of the backlight, and the [remainders] remaining anode electrodes are commonly connected to a second bus line which is formed on the other portion of the inner surface of the front plate of the backlight, and two of the R, G and B cathode electrodes corresponding to the R, G and B anode electrodes are commonly

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Marked-up Claims 1, 6 and 7

connected to a third bus line, and the [remainder] remaining cathode electrode is connected to a fourth bus line.

7. (Amended) The liquid crystal display of claim 6, wherein the first and second bus lines are installed in parallel on both [sides] either of an array of the R, G and B anode electrodes.

Abstract of the Disclosure

A liquid crystal display including a liquid crystal panel and a backlight. The liquid crystal panel has a front plate and a rear plate between which liquid crystal [sandwiches] is interposed, wherein electrodes for driving the liquid crystal on a pixel-by-pixel basis, pixel electrodes corresponding to the common electrodes, and thin film transistors (TFTs) for driving the pixel electrodes are installed on the inner surface of each of the front and rear plates. The backlight has a front plate and a rear plate, wherein a plurality of R, G and B anode electrodes, on which fluorescent layers are formed, are formed in parallel on the front plate, cathode electrodes corresponding to the anode electrodes are formed on the rear plate, and light emitting units for colors according to the anode electrodes and the cathode electrodes are installed to provide light of each of R, G and B colors to each pixel of the liquid crystal panel. Color pixels are formed on a liquid crystal panel to match one pixel with backlight of three colors, instead of unit pixels formed by colors on the liquid crystal panel. Thus, the opening ratio of the liquid crystal panel increases, and the integration density thereof can be reduced, thereby simplifying the production process of the liquid crystal panel and reducing the manufacturing costs for the liquid crystal panel. In particular, the yield greatly improves.